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SURVEY OF THE COLUMBIA RIVER AND ITS TRIBUTARIES - Part V

SPECIAL SCIENTIFIC REPORT: FISHERIES No. 38

UNITED STATES DEPARTMENT OF THE INTERIOR
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Explanatory Note

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Washington, D. C.
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United States Department of the Interior
Oscar L. Chapman, Secretary
Fish and Wildlife Service
Albert M. Day, Director

Special Scientific Report - Fisheries

No. 38

SURVEY OF THE COLUMBIA RIVER AND ITS TRIBUTARIES

PART 5

By

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Fishery Research Biologist

CONTENTS

	Page
Introduction.	2
Part 1. Sub-Area Deschutes and John Day River Systems,	
List of Streams	4
The Survey.	5
Table of Obstructions and Diversions.	20
Part 2. Sub-Area Umatilla and Walla Walla River Systems,	
List of Streams	24
The Survey.	26
Table of Obstructions and Diversions.	39

ILLUSTRATIONS

FIGURE Page

1. Columbia River System 1

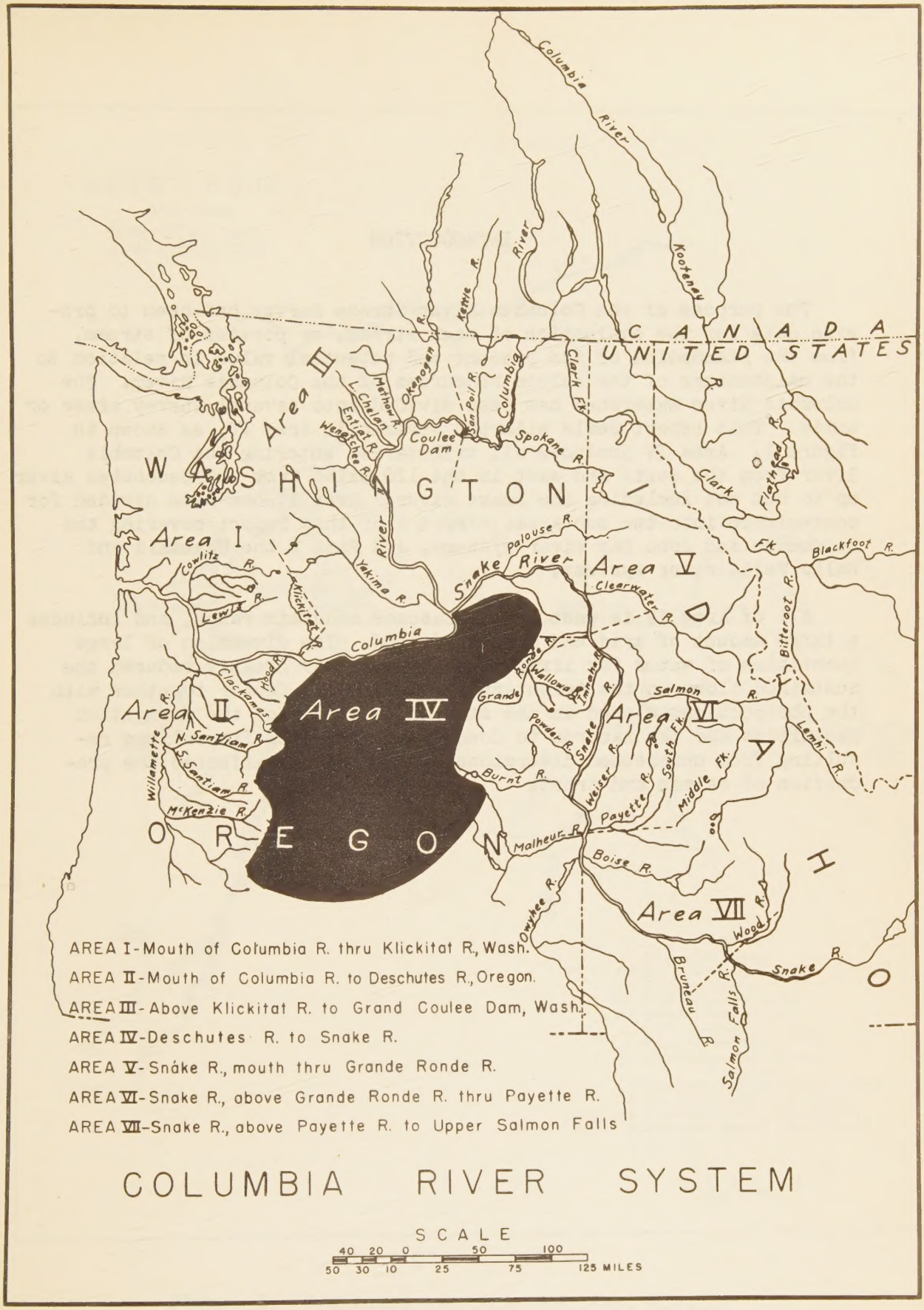
2. Deschutes and John Day River Systems. 3

3. Typical smooth-water section of Deschutes River above Bend, Oregon. 8

4. Typical canyon section of Crooked River near Terrebonne, Oregon. 13

5. Diversion dam on the Crooked River, approximately 33 miles above the mouth. 14

6. Umatilla and Walla Walla River System 23



AREA I-Mouth of Columbia R. thru Klickitat R., Wash.
AREA II-Mouth of Columbia R. to Deschutes R., Oregon.
AREA III-Above Klickitat R. to Grand Coulee Dam, Wash.
AREA IV-Deschutes R. to Snake R.
AREA V-Snake R., mouth thru Grande Ronde R.
AREA VI-Snake R., above Grande Ronde R. thru Payette R.
AREA VII-Snake R., above Payette R. to Upper Salmon Falls

COLUMBIA RIVER SYSTEM

SCALE

40 20 0 50 100
50 30 10 25 75 125 MILES

Figure 1. Columbia River System

INTRODUCTION

The purpose of the Columbia River Stream Survey has been to provide data for the evaluation of each stream, or portion of stream, from the standpoint of its present and potential value in relation to the maintenance of the salmon resources of the Columbia River. The Columbia River watershed has been divided into several survey areas or units. This report deals with the streams in Area IV, as shown in Figure 1. Area IV includes all tributaries entering the Columbia River from the south and east in the 120 miles from the Deschutes River up to but not including the Snake River. Area IV has been divided for convenience into two sub-areas; Part 1 of this report covering the Deschutes and John Day river systems, and Part 2 the Umatilla and Walla Walla river systems.

All of Area IV is east of the Cascade mountain range, and includes a large amount of arid and semi-arid land. The diversion of large quantities of water for irrigation purposes has greatly reduced the sustained flows in the tributary streams. This factor together with the obstructions placed in the streams as a part of the irrigation facilities and the hazards to downstream migrating fingerlings resulting from unscreened diversions have adversely affected the production of salmon and trout.

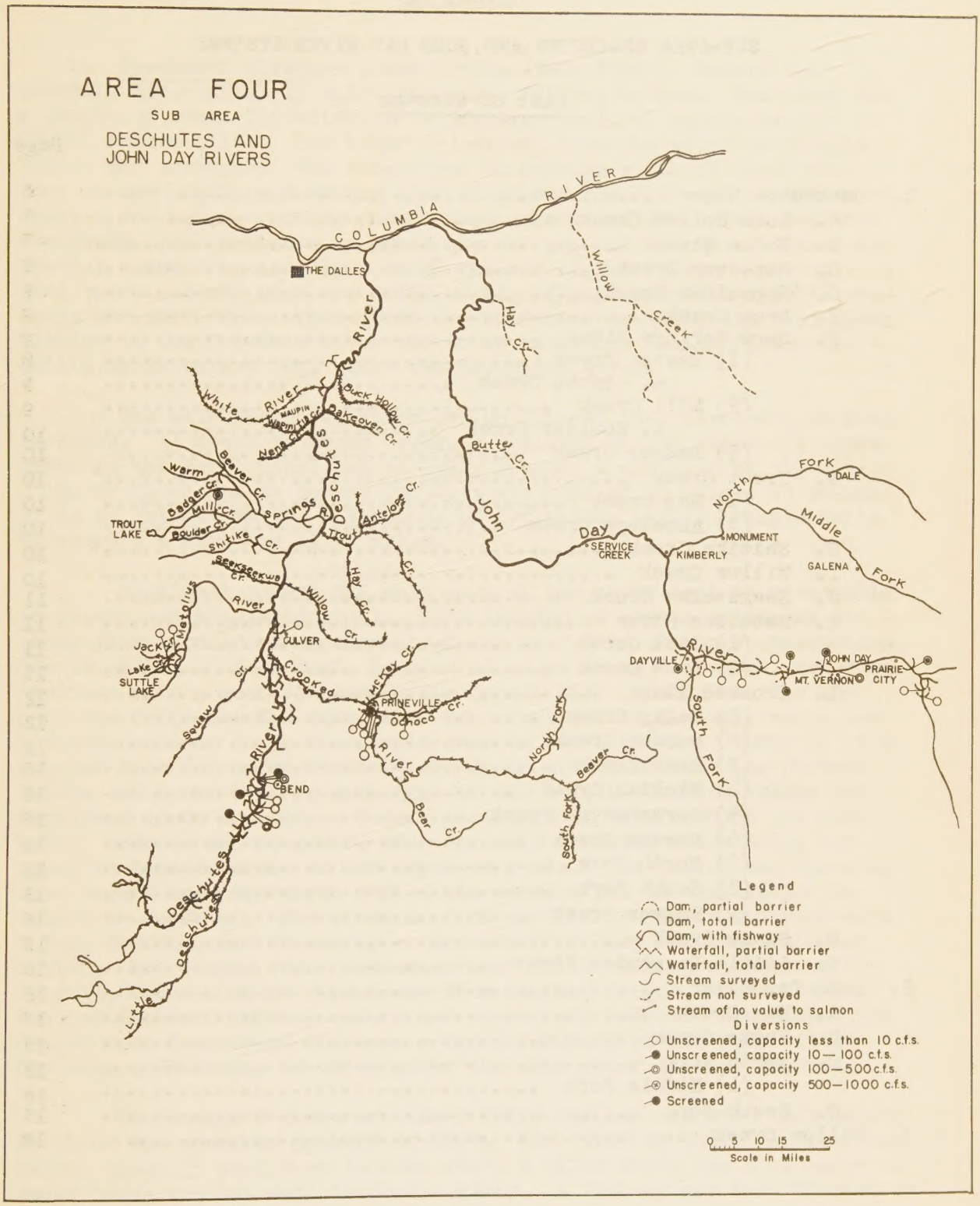


Figure 2. Deschutes and John Day River Systems

PART 1

SUB-AREA DESCHUTES AND JOHN DAY RIVER SYSTEMS

List of Streams

		Page
1.	Deschutes River	5
	A. Buck Hollow Creek	7
	B. White River	7
	C. Bakeoven Creek	9
	D. Wapanitia Creek	9
	E. Nena Creek	9
	F. Warm Springs River	9
	(1) Beaver Creek	9
	a. Butte Creek	9
	(2) Mill Creek	9
	a. Boulder Creek	10
	(3) Badger Creek	10
	G. Trout Creek	10
	(1) Hay Creek	10
	(2) Antelope Creek	10
	H. Shitike Creek	10
	I. Willow Creek	10
	J. Seekseekwa Creek	11
	K. Metolius River	11
	(1) Jack Creek	11
	(2) Lake Creek	11
	L. Crooked River	12
	(1) McKay Creek	12
	(2) Ochoco Creek	15
	(3) Bear Creek	15
	(4) Wickiup Creek	15
	(5) Horseheaven Creek	15
	(6) Newsom Creek	15
	(7) North Fork	15
	(8) South Fork	15
	(9) Beaver Creek	15
	M. Squaw Creek	15
	N. Little Deschutes River	16
2.	John Day River	16
	A. Hay Creek	17
	B. Butte Creek	17
	C. North Fork	18
	(1) Middle Fork	18
	D. South Fork	18
3.	Willow Creek	19

The Survey

1. Deschutes River.-- (June 19-24, 1942; Frey.) Enters the Columbia River about 15 miles above The Dalles, Oregon. The river has a length of about 245 miles and a drainage basin of approximately 10,500 square miles. The lower 217 miles, from the mouth to Pringle Falls, was surveyed. The stream has an average width of about 500 feet at the mouth, and at the time of survey the flow was estimated at about 4,000 c.f.s. Spring run chinook salmon and spring and fall run steelhead trout continue to enter the stream. It is reported that the present salmon run is only a small remnant of its former size, but that the steelhead runs are still of significant proportions, particularly the fall runs. These fish are subjected to commercial and sport fishing in the Columbia River and to an extensive Indian fishery at Celilo Falls before they enter the Deschutes River.

The main Deschutes River can be divided into five well defined sections: 1) Mouth to Squaw Creek, a distance of 136 miles; 2) Squaw Creek to the North Canal Dam at Bend, Oregon, a distance of 37½ miles; 3) North Canal Dam to Benham Falls, a distance of 14 miles; 4) Benham Falls to Pringle Falls, a distance of 28½ miles; and 5) Pringle Falls to source, a distance of 29 miles.

Section 1 covers the only part of the river that is accessible to salmon and steelhead trout. This section of stream maintains a large flow of cold water throughout the year, and the only obstruction, Sherar Falls, 15 feet high, located 45 miles above the mouth, has been provided with a good fishway by the Oregon Fish Commission. In the past the falls was the site of an important Indian fishery, and a few Indians continue to go there each year to catch salmon. Today it is a popular spot for sport fishing, and it is estimated that the present Indian and sport fishing accounts for 500 - 1,000 chinook salmon and steelhead trout annually. Bottom materials in this section are dominately bedrock and boulders, with suitable spawning areas being confined to limited areas at the edges of pools. One fair-sized spawning area occurs near the upper end of the section but no utilization by salmon is reported. The river in this section is narrow and deep with a fast current, and is mainly a succession of deep resting pools and rapids. The Oregon Fish Commission operates a rearing station at Oak Springs, about 4 miles downstream from Maupin, Oregon, where several hundred thousand chinook salmon are reared and released annually. The Oregon Game Commission operates a trout hatchery at the same site. The only tributaries of value enter the main river in this section.

In Section 2 there are three falls and two cascades that impede or block the upstream passage of fish. The first of these is Steelhead Falls, about 15 feet high located about 4 miles above the confluence of Squaw Creek and the main Deschutes River. A fishway has been blasted in

the bedrock around the east side of the falls, but at the time of observation it was in a state of disrepair and was impassable. Big Falls, 30 feet high, is located about 3½ miles above Steelhead Falls. It has a fair 9-step fishway, but it too is impassable at times because of a lack of water, and at such times the falls must be considered as a barrier. These falls marked the upstream limit of migration of chinook salmon and steelhead trout under natural conditions. Odin Falls, 6 miles above Big Falls, is scarcely more than a cascade with a drop of about 10 feet in 50 yards. Cline Falls, 5 miles above Odin Falls, has a drop of about 30 feet plus an additional 3 feet created by a wooden splash dam across the crest. The fishway was in a state of disrepair at the time of observation. Aubrey Falls, 7 miles above Cline Falls, is another cascade having a drop of about 15 feet in 100 yards. The North Canal Dam, marking the upper boundary of this section of the main Deschutes River, is a concrete structure 30 feet high. There is a broken-down fishway at the center of the dam. Thus this dam, like the falls, is a barrier to fish. At this point diversions have removed so much of the flow that only a scant 15 or 20 c.f.s. is allowed to spill over the dam during the period from March to November. During the balance of the year additional water passes over the dam, but this could benefit only a few late fall run steelhead trout in this section of stream. This low flow makes it impossible to attempt to pass fish through this section to the upper portion of the river. It is doubtful that the upper stream sections are of great enough value to justify fishways at the three falls and at the dam, even if a sufficient volume of flow could be provided. Suitable spawning area is limited to a few good riffles near Tumalo, Oregon. No tributaries of importance enter this section.

Section 3: The Swalley (80 c.f.s.) and North Canals (400 c.f.s.) divert water at the North Canal Dam. A third large canal, built by the U.S. Bureau of Reclamation also diverts about 1,000 c.f.s. at this point in connection with agricultural development in the Madras area.

The Deschutes County Municipal Improvement District dam, 7 feet high, is located in the city of Bend. It is of concrete construction, and has a 6-step fishway. From 60-80 c.f.s. is diverted at the dam to supplement the Tumalo project feed canal.

The Pacific Power and Light Company dam is located about 1/4 mile above the county dam. It is about 15 feet high and has a poor fishway. The Shevlin-Hexon lumber mill dam is located about 1 mile above the Pacific Power and Light Company dam. It is of wooden construction, about 6 feet high, and has a good fishway. The Scanlon-Brooks lumber mill dam, located a short distance farther upstream, is similar to the Shevlin-Hexon dam.

The Central Oregon Irrigation Canal diverts from 350 to 400 c.f.s. about midway between Bend and Lava Island Falls. These falls are actually a series of cascades having a total drop of about 100 feet in a distance of about 1 mile, and in no way constitute a barrier. The Arnold Canal, diverting from 60 to 70 c.f.s. takes off immediately above Lava Island falls. Dillion falls, located about 2½ miles above Lava Island falls, is another series of cascades and falls with a total drop of about 65 feet in a distance of 0.3 of a mile, and is not a total barrier. Benham falls likewise is a series of cascades and low falls dropping about 95 feet in a distance of about 1/2 mile, and is not a serious barrier.

No suitable spawning areas were observed in this section. From the North Canal dam to Dillon falls bottom material is mainly bedrock and boulders, and from Dillon falls upstream to Benham falls sand and mud predominate.

Section 4: This is a quiet water section, almost slough-like in character. Bottom materials are mainly mud and sand, and no suitable spawning areas were observed. There are no obstructions or diversions. Pringle falls, forming the upper boundary of this section, is a series of cascades dropping about 25 feet in a distance of about 1/2 mile, and in no way constitutes a barrier to fish. This section is of no value to salmon.

Section 5: The stream increases in gradient above Pringle falls, and in this section occurs the only large suitable spawning areas found in the main Deschutes River. It is inaccessible to salmon however, because of the obstructions in Section 2 as well as the impassable Wickiup dam, 90 feet in height, located about 8 miles above Pringle falls. During the filling period of late fall and winter at the Wickiup reservoir the small amount of water permitted to pass the dam further limits the fisheries value of the stream section below to the confluence of the Little Deschutes River. Crane Prairie dam, 35 feet high and situated about 12 miles above Wickiup dam is also impassable. No improvements appear justified and this section must be considered as having no value to salmon.

1A. Buck Hollow Creek.-- (June 19, 1942; Frey.) Enters the Deschutes River about 1 mile below Sherar falls. This is a small stream flowing about 4 c.f.s. at the time of survey and reported to go completely dry in late summer. It is of no value to salmon.

1B. White River.-- (June 19, 1942; Frey.) Enters the Deschutes River about 2.5 miles above Sherar falls. The stream has a length of about 50 miles, but it is blocked by a series of three falls totaling 180 feet in height about 2½ miles above the mouth. These falls are surmounted by a power dam 6 feet high used to divert water to the Pacific Power and Light Company plant located in the gorge below the falls. In the 2½ mile section below the falls bottom materials are largely bedrock and sand, and suitable spawning areas are almost entirely lacking. A few chinook salmon enter this section of stream each year. However, it is only of slight value as a salmon producer.

Figure 3. Typical smooth-water section of Deschutes River above Bend, Oregon.

1C. Bakeoven Creek, 1D. Wapinitia Creek, and 1E. Nena Creek.-- (June 19-20, 1942; Frey.) These are small, intermittent streams that enter the Deschutes River in the vicinity of Maupin, Oregon. They become completely dry in summer, and are of no value to salmon.

1F. Warm Springs River.-- (June 20, 1942; Frey.) Enters the Deschutes River about 30 miles above Maupin, Oregon. The stream has an approximate length of 48 miles, most of which was surveyed. All of this stream and its tributaries lie within the boundaries of the Warm Springs Indian Reservation. The main river has suitable spawning areas adeuqate for large runs of salmon and steelhead trout, and is one of the two important salmon streams in the Deschutes River system. The Indian Agency reports that the Indians take from 50 to 100 chinook salmon from the river each year. No definite information was available regarding the catch of steelhead trout.

There are only two small dams in the river that interfere with the upstream migration of fish. The first of these is a flashboard-type structure, 5.5 feet high, located at Hot Springs about 8 miles above the mouth of the stream. The dam has a poor, loose-rock spillway that makes the structure impassable during low water periods. The second is a log-crib dam about 3 feet high located a short distance above the road bridge at HeHe.

1F - (1). Beaver Creek.-- (June 20, 1942; Frey.) Enters Warm Springs river about 25 miles above the mouth. The stream has a length of about 20 miles, all of which was examined. This is a good salmon stream and maintains an adequate flow of water during the summer. It has an average width of about 30 feet, and at the time of survey the flow was estimated at about 100 c.f.s. The greater part of the chinook salmon run entering Warm Springs river proceed to this tributary to spawn. There are no natural or artificial obstructions in the creek and none of its water is diverted.

1F - (1)a. Butte Creek.-- (June 20, 1942; Frey.), Enters Beaver Creek 12 miles above the mouth. The stream is about 8 miles long, has an average width of 20 feet near the mouth, and at the time of survey the flow was estimated at 20 c.f.s. There is sufficient suitable spawning area to accommodate a small run of chinook salmon.

1F - (2). Mill Creek.-- (June 20, 1942; Frey.) Enters Warm Springs river about 27 miles above the mouth. The stream is approximately 27 miles long, is about 20 feet wide at the mouth, and at the time of survey was flowing about 60 c.f.s. Suitable spawning areas were observed in the middle section of the stream. A few chinook salmon enter this stream every year but it could easily support many more. The only dam on the stream is located about 1/2 mile above the road bridge. It is formed by a single log, 3 feet in diameter, and is easily passable. This dam diverts from 10 to 15 c.f.s. into a large unscreened irrigation ditch. The Indian Agency reported that a falls blocking the ascent of fish to Trout lake was blasted out in 1939.

1F - (2)a. Boulder Creek.-- (June 20, 1942; Frey.) Enters Mill Creek 5 miles above the mouth. The stream has a length of about 17 miles, and at the time of survey the flow was estimated at 10 c.f.s. Suitable spawning areas were limited, with bottom materials being composed mainly of bedrock and silt. No salmon or steelhead were reported to enter this stream, and it could have only limited value.

1F - (3). Badger Creek.-- (June 20, 1942; Frey.) Enters Warm Springs river about 33 miles above the mouth. The stream is about 20 miles long, has an average width of about 20 feet, and at the time of survey the flow was estimated at 20 c.f.s. Suitable spawning areas were infrequent with bottom materials consisting largely of bedrock and silt. There were no reports of salmon or steelhead entering this stream.

1G. Trout Creek.-- (June 20, 1942; Frey.) Enters the Deschutes river about 3 miles above the mouth of Warm Springs river. The creek is about 40 miles long, has an average width of about 12 feet, and at the time of survey was flowing about 10 c.f.s. In late summer the flow is further reduced and in some years the lower stream section is entirely dry. It is reported that this condition prevailed even before there was any water diverted for irrigation. The former watermaster of Willowdale reported that there were twelve diversions from the stream in the Willowdale Valley and an equal number in the Ashwood Valley. Small, temporary dams are placed across the stream at each of the points of diversion. None of these dams are barriers to fish, but none of the diversions are screened. The only permanent dam on the stream is the Hiline Canal dam located 10 miles above Willowdale. This is a flashboard type structure, 6 feet high, that would be a barrier when the flashboards are in place. It was reported that 35 years ago large runs of steelhead trout entered this stream, but that none have been taken in recent years. Trout Creek is considered to be of no present value to salmon.

1G - (1). Hay Creek and 1G - (2). Antelope Creek.-- (June 20, 1942; Frey.) These are small, intermittent tributaries of Trout Creek that are of no value to salmon or steelhead trout.

1H. Shitike Creek.-- (June 20, 1942; Frey.) Enters the Deschutes River 8 miles above the mouth of Trout Creek. The stream is about 33 miles long, has an average width of 30 feet at a point 1 mile above the mouth, and at the time of survey was flowing about 120 c.f.s. A falls 60 feet high on an average slope of 30° blocks the stream 10 miles above the mouth. Suitable salmon spawning areas were noted both below and above the falls. The stream maintains an adequate flow of water throughout the year. There are a few low passable dams and small unscreened irrigation diversions in the vicinity of the Indian Agency.

1I. Willow Creek.-- (June 21, 1942; Frey.) Enters the Deschutes river about 7 miles above Shitike Creek. It is a small, intermittent, stream, and was dry at the time of survey. It has no value to salmon.

1J. Seekseekwa Creek.-- (Unsurveyed) Enters the Deschutes River about 1 mile above Willow Creek. This stream has a very steep gradient in the first 2 miles, and is probably impassable to salmon. There were no reports of salmon or steelhead trout entering the stream.

1K. Metolius River.-- (June 21-22, 1942; Frey.) Enters the Deschutes River about 5 miles above Seekseekwa Creek. It is about 40 miles long, has an average width of from 100 to 150 feet near the mouth, and at the time of survey the flow was estimated at about 1,000 c.f.s. Flow and temperature are remarkably constant. This is the most important chinook salmon and steelhead trout stream in the entire Deschutes River system. Runs of these fish continue to enter the stream in significant numbers. Blueback salmon formerly ascended to Suttle Lake, but none have been seen for a number of years. Suitable spawning areas are abundant in the upper section, beginning about 8 miles below Camp Sherman. Chinook salmon spawn in the upper section, while steelhead trout utilize suitable areas all along the stream. It was reported that the runs in 1940 were the largest in the previous 20 years.

There are no natural obstructions in the stream, and the low wing dams of ranches in the lower section, as well as the few small dams in the upper resort area are all passable to fish. Small amounts of water are diverted by wing dams, paddle wheels, and pumps into unscreened ditches and pipe lines for small scale irrigation, stock watering, and domestic use.

1K - (1). Jack Creek.-- (June 22, 1942; Frey.) Enters the Metolius River 2½ miles below Camp Sherman. The stream is about 5 miles long, has an average width of about 25 feet near the mouth, and at the time of survey the flow was estimated at about 60 c.f.s. The stream is blocked by two dams, the upper appearing to be impassable at all times. The first dam is located about 1/2 mile above the mouth of the stream. It is a log and flash board structure about 3 feet high, and was impassable at the time of examination because there was only seepage through it. An unscreened ditch diverts about 15 c.f.s. The second dam is about 2 miles further upstream. It is of log-crib construction with a center flash board section about 3 feet high and a wooden downstream apron about 15 feet long. No water was spilling over the dam at the time of survey, but was seeping through the cribbing and between the flash boards. The unscreened diversion taking off above this dam was carrying about 40 c.f.s. at the time of survey.

Suitable spawning areas were observed only in the lower mile. Above this point the stream bed contains numerous large boulders and logs, the gradient becomes steeper, and suitable spawning areas are small and few in number. It was reported that salmon have never been known to enter this stream.

1K - (2). Lake Creek.-- (June 22, 1942; Frey.) This stream rises in Suttle Lake and enters the Metolius River about 1/2 mile above Camp Sherman. It is about 5 miles long, averages about 25 feet in width, and at the time of survey was flowing 30-40 c.f.s. There is abundant suitable spawning area

in all but the upper mile. Its accessibility to salmon and steelhead trout, however, is impaired by two dams near the Lake Creek Lodge. The first of these is a swimming pool dam at the lodge. This dam has a drop of only 14 inches but the loose stone apron below it makes the structure impassable except when the flash board is out. The second dam is about 2½ feet high at the flashboard-spillway section

There is a concrete power dam, 4 feet high, at the outlet of the stream from Suttle Lake. This dam is not important to chinook salmon and steelhead trout, but it may have been responsible for the disappearance of the blueback salmon run. The spillway has a 15-inch flashboard at the upper end of a sloping concrete apron 11 feet long that would be impassable except under very favorable circumstances. The 3-step fishway is too small for large fish and is blocked at the upper end by a stationary screen. Two rotary screens prevent the escapement of fish from the lake to the creek. The diversion to the small power plant is screened.

1L. Crooked River.-- (June 21, 25, and 26, 1942; Frey.) Enters the Deschutes about 3½ miles northwest of the town of Culver, Oregon, and extends for 115 miles. It is the largest tributary of the Deschutes River. Runs of chinook salmon and steelhead trout formerly entered the stream, but no salmon and only an occasional steelhead now are reported. Extensive water use has been largely responsible for this condition and it continues to be the limiting factor in attempting to improve present conditions. In addition, there is a general absence of suitable spawning areas in the main river, and most of the tributaries have little or no value to salmon because of their intermittent nature. There are five large diversions near the town of Prineville, Oregon, and numerous small ones in the 80 mile section between Prineville and the headwater streams. Because of the general low stream flows none of the dams in connection with these diversions would be passable during low water stages.

From Prineville to the mouth the stream flows through a deep, narrow canyon. Conditions for salmon are no better here than in the upper section. Bottom materials are largely bedrock and boulders with little or no suitable spawning areas observed. The gradient is steep and the stream is scarcely more than a series of cascades. Low water conditions persist in this section to within 7 miles of the mouth of the river, where Opal Springs adds a flow of approximately 1,000 c.f.s. to the stream. This 7-mile section, although having a sufficient flow of water, is completely lacking in suitable spawning areas. The Pacific Power and Light Company operates a power plant on the stream about 2½ miles above the mouth.

It appears doubtful that Crooked River was ever of great importance to salmon and it is certain that under present conditions there is little to recommend it as a salmon stream.

1L - (1). McKay Creek.-- (June 25, 1942; Frey.) Enters Crooked River about 5 miles below Prineville, Oregon. This small stream goes completely dry in low precipitation years. There are five small diversions in the upper part of the stream, and most of the water near the mouth is diverted into the Ochoco Irrigation Canal during the summer. It is of no value to salmon.

Figure 4. Typical canyon section of Crooked River near Terrebonne, Oregon.

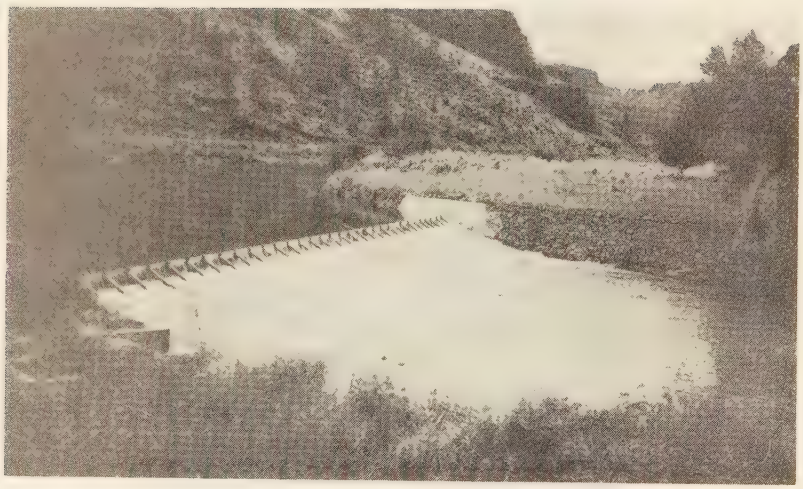


Figure 5. Diversion dam on the Crooked River, approximately 33 miles above the mouth.

1L - (2). Ochoco Creek.-- (June 25, 1942; Frey.) Enters Crooked River about $2\frac{1}{2}$ miles below Prineville, Oregon. It is blocked by a dam 110 feet high located 6 miles above Prineville. Very little water is by-passed to the stream below the dam, but it maintains a small flow from seepage and springs which also supplies five diversions. Sometimes this lower section is completely dry. The stream has no value to salmon.

1L - (3). Bear Creek.-- (June 25, 1942; Frey.) Enters Crooked River 20 miles above Prineville, Oregon. This stream is of no value to salmon because of the small stream flow during the spawning period. In some years it becomes completely dry.

1L - (4). Wickiup Creek, 1L - (5). Horseheaven Creek, and 1L - (6). Newsom Creek.-- (June 24-25, 1942; Frey.) These small tributary streams of Crooked River are intermittent, lack suitable spawning areas, and thus are of no value to salmon.

1L - (7). North Fork.-- (Unsurveyed) The North Fork is one of the principle headwater tributaries of Crooked River, and has some suitable spawning areas. It is blocked 12 miles above the mouth by a falls 20-25 feet high. Any possible value to anadromous fish is nullified by the poor conditions prevailing in the main Crooked River.

1L - (8). South Fork.-- (June 24, 1942; Frey.) Joins Beaver Creek to form the main Crooked River 115 miles above the mouth of the latter stream. It is about 30 miles long, has an average width of about 8 feet, and at the time of survey was flowing about 5 c.f.s. The stream has few suitable spawning areas, an intermittent flow subject to high water temperatures, and is of no value to salmon.

1L - (9). Beaver Creek.-- (June 25, 1942; Frey.) The stream is about 19 miles long from its mouth to the confluence of its north and south forks. It has some good suitable spawning areas and others were reported in its two principle tributaries. Old residents report that chinook salmon were caught in the stream 40 to 50 years ago but that few have been seen in recent years. An occasional steelhead trout has been reported from the stream.

1M. Squaw Creek.-- (June 22, 1942; Frey.) Enters the Deschutes River about 4 miles below Steelhead falls. There are ten dams and diversions on this creek above the town of Sisters, Oregon. In the summer the diversions take the entire stream flow, leaving a 3-mile section near Sisters completely dry. Below this dry section a series of springs maintains a flow of about 20 c.f.s. to the mouth of the stream, a distance of about 15 miles. None of the dams have spillways, and all are barriers during low water. None of the diversions are screened. The only suitable spawning areas are located in the upper portion above the dry section. It was reported that steelhead trout continued to enter this stream up to a few years ago, but there were no reports of salmon having entered the stream. Water rights on the stream preclude the maintenance of an adequate flow to eliminate the dry section near Sisters. In its present condition the stream is of little or no value to anadromous fish.

IN. Little Deschutes River.-- (June 24, 1942; Frey.) Enters the Deschutes River about 23 miles above the city of Bend, Oregon. It is about 65 miles long and has an average width of about 50 feet. Except in its headwaters it is a sluggish stream having few if any suitable spawning areas. Bottom materials are largely mud and sand. It is of little or no possible value to salmon or steelhead trout, and is inaccessible because of the falls in the main Deschutes River below Bend.

2. John Day River.-- (September 7,8, and October 10, 1942 ; Parkhurst and Bryant. Rechecked May 28-29, 1944; Nielson.) Enters the Columbia River about 33 miles above The Dalles, Oregon, and about 18 miles above the confluence of the Deschutes River. The main river is about 227 miles long and has a drainage basin of about 8,000 square miles in the semi-arid, north-central section of the state of Oregon. An examination of the flow records taken at the gauging station located 16 miles above the mouth indicates a wide variation in the rate of flow. The maximum discharge during the period of record (1904-5-1935-36) was 24,900 c.f.s. measured on March 20, 1932, and the minimum discharge was 4 c.f.s. on August 31, 1931. Minimum flows occur during the months of August, September, and October. In May and June when the spring runs of chinook salmon and steelhead trout normally would be entering the stream the average discharge is 2,000-5,000 c.f.s. but may be as low as 350 c.f.s. The lower section of the river is sluggish and often turbid.

From the mouth of the stream, to Hay Creek, a distance of 30 miles, the gradient is slight to moderate and the bottom is composed chiefly of sand, silt, and large rubble. Riffles are few and poor and there is no suitable spawning area. Resting pools, however, are almost continuous although they lack cover and generally are of poor quality. In the next section, from Hay Creek upstream to Butte Creek, a distance of 43 miles, the gradient is moderate to fairly steep. The stream bottom is composed principally of broken bedrock, sand, and silt and the few riffle areas suitable for spawning are of poor quality. Resting pools continue to be large and numerous but they lack cover and are of poor quality. Similar conditions continue upstream to Dayville, Oregon. In the 47 mile section from Dayville to 3 miles above Prairie City the river has a moderate gradient. Spawning riffles are numerous throughout and in the upper 14 miles of this section they are of an excellent nature, at least 75 percent of the total bottom area being suitable for spawning. At the time of observation there was a large gold dredge operating on the river about 21 miles below Prairie City near the town of Mt. Vernon and moving slowly downstream. It had torn up 10 miles of the river bottom above this point, where the stream bed was transformed into numerous conical mounds of gravel tailings 8-12 feet high around which the river meandered through numerous small channels. During low water periods, as at the time of inspection, this condition would greatly impede if not entirely block the upstream passage of adult fish and also would be a hazard to downstream migrants. Another serious problem resulting from the activity of gold dredges is that the water is rendered extremely turbid below them and the heavy burden of silt is deposited over the stream bed. Thus, vast areas are

rendered unsuitable for salmon spawning although the dredge itself may not reach them for years. All gold mining activities in the John Day River system were suspended during the war. Observations made in 1944 indicate that normal stream action had cleaned the silted areas in the short span of two years, making them again suitable for spawning. Dredging, according to local reports, has been proceeding intermittently for about 25 years, and very probably has contributed to the depletion of the salmon runs in the river. Of the many local residents interviewed, none had seen or heard of a salmon in the upper main river for many years, but all spoke of the large runs of 25 or 30 years ago. It was reported that large runs of steelhead trout also formerly entered the river. Runs of these fish are greatly depleted at the present time, but some continue to come into the river each year and a few are taken by anglers. Most of the steelhead in the present runs enter the North and Middle Forks and proceed to their tributaries to spawn. The 1944 run was the heaviest for the past 10 years and attracted many anglers to Camas Creek, a tributary of the North Fork. Numerous plantings of steelhead fingerlings have been made in this stream by the Oregon Game Commission.

The only permanent barrier to the migration of fish on the main John Day River, aside from the dredged sections described above, is the West Coast Power and Light Company dam located about 3 miles above Prairie City. This dam is 6 feet high, has no fishway, and is a barrier to upstream migration except perhaps for a few steelhead trout. Approximately 60 c.f.s. is diverted at this point for the generation of electric power. The diversion is not screened. However, the remaining 12 miles of stream above this structure is of little possible value to salmon and steelhead.

In the main river valley beginning a few miles above Prairie City and extending downstream to Dayville water is extensively diverted for irrigation. There are eleven major diversions in this section carrying from 5 to 40 c.f.s., and numerous smaller ones diverting from less than 1 to 3 c.f.s. None of these diversions were provided with screens at the time of survey. All of the dams in connection with these diversions are of temporary construction. They are loose rock and brush structures rarely exceeding 2 feet in height, and because of their loose construction no water spills over their crests, but percolates through from end to end. Thus, while these structures are in place they are barriers to both upstream and downstream migrants. These dams are usually put in during the month of May and are carried away by the early spring freshets the following year.

There are numerous tributaries to the main John Day River, but only the North Middle, and South Forks and a few of their larger tributaries are of present or potential value to salmon and steelhead trout.

2A. Hay Creek and 2B. Butte Creek.— (Unsurveyed) Small, intermittent tributaries of the lower John Day River that are of no value to salmon and steelhead trout.

2C. North Fork.-- (September 7-8 and October 10, 1942; Parkhurst and Bryant. Re-checked May 28, 1944; Nielson.) Enters the John Day River at Kimberly, Oregon. The stream is about 84 miles long, has an average width of about 150 feet near the mouth, and at the time of survey the water temperature in the lower 12-mile section was 65°F. Low water stages occur in the months of September and October. The discharge is generally 85-125 c.f.s., becoming as low as 50 c.f.s. in some years. Hydraulic mining operations in the headwaters caused the stream to be very turbid at the time of our first survey. A thick layer of silt was deposited over the bottom, covering extensive areas of otherwise suitable spawning and rearing areas. Mining activities were suspended in 1942 because of the war and, when checked in 1944, the stream was crystal clear and normal stream action had practically eliminated the silt problem. Good resting pools with excellent cover are numerous, particularly in the 25-mile section above Dale, Oregon. There are a few small irrigation diversions. The diversion dams are of temporary construction and are usually passable to fish. There are four dams of the Eastern Oregon Light and Power Company located on minor tributaries in the vicinity of Olive Lake and two dams operated by mining and timber interests located on a minor tributary rising in Crawfish Lake. None of the minor tributaries are of significant value to salmon or steelhead trout.

It is apparent that the North Fork was at one time an excellent spawning and rearing stream for salmon and steelhead. No large run of salmon has entered this stream for at least the last 25 years, but some steelhead trout continue to enter. One of the largest steelhead runs of the previous ten years was reported in 1944. A large part of this run entered Camas Creek, attracting anglers from near and far. The Oregon Game Commission has made numerous plantings of steelhead fingerlings in this stream.

2C - (1). Middle Fork.-- (Sept. 7-8 and Oct. 10, 1942; Parkhurst and Bryant. Re-checked May 28, 1944; Nielson.) Enters the North Fork of the John Day River 25 miles above the mouth and has a total length of about 54 miles. In the lower 25 miles the stream gradient is moderate, and there are numerous shallow riffle areas and adequate resting pools. There are extensive suitable spawning areas, but at the time of our first survey the stream bed was covered with silt resulting from gold mining operations 2½ miles above the town of Galena, Oregon. In the upper stream section above the site of mining operations suitable spawning area is negligible. In 1944, following two years of no mining activity, the water was very clear and normal stream action had practically removed all silt from the stream bed.

The Middle Fork at one time was an excellent producer of chinook salmon and steelhead trout, and at the present time it has good potential fisheries value.

2D. South Fork.-- (Sept. 7-8 and Oct. 10, 1942; Parkhurst and Bryant. Re-checked May 28, 1944; Nielson.) Enters the John Day River at Dayville, Oregon, and has a total length of about 36 miles. It is the smallest of the

main tributaries of the river and is subject to extreme low water flows in late summer. The gradient is moderate throughout except in the extreme headwaters. Suitable spawning areas are numerous, riffles are frequent, and resting pools are adequate. Water for domestic and irrigation purposes is diverted from the stream about 3 miles above the mouth, withdrawing practically the entire summer flow. The diversion dam is easily passable during high water, but the diversion is unscreened.

The present and potential value of this stream to salmon and steelhead trout is limited by the low water flow.

3. Willow Creek.-- (May 23, 1944; Nielson.) Enters the Columbia River about 11 miles above Arlington, Oregon, near Heppner Junction. This is a small stream draining an extensive, semi-arid region of north-central Oregon. It is largely diverted for irrigation, the entire summer flow being thus utilized. It has no value to salmon or steelhead trout.

TABLE OF OBSTRUCTIONS AND DIVERSIONS [1]

Name of Stream	Height in Feet Falls	Height in Feet Dams	Diversions in c.f.s.	Protective Devices
Deschutes River	15			Fishway-fair
" "	15			Fishway-poor
" "	30			Fishway-fair
" "	30			Fishway-poor
" "	(6) low			None-passable
" "		30		Fishway-poor
" "			10	None
" "			100	None
" "			1,000	None
" "		7		Fishway-fair
" "			100	None
" "		15		Fishway-poor
" "		6		Fishway-good
" "		6		Fishway-good
" "			(2)100	Not examined
" "		90		None
" "		35		None
White River	180			None
Warm Springs River		5½		None

1/ Numbers shown in parentheses are total number of falls, dams, or diversions.

TABLE OF OBSTRUCTION AND DIVERSIONS

Name of Stream	Height in Feet Falls	Dams	Diversions in c.f.s.	Protective Devices
Warm Springs River		3		None-passable
Mill Creek		3		None-passable
" "			10	None
Trout Creek		(24)low		Passable
" "			(24) 10	None
" "		6		None-passable
Shitike Creek	60			None
Metolius River		Few low		None-passable
" "			Few small	None
Jack Creek		3		None
" "			(2) 10	None
Lake Creek		1		None
" "		3		None
" "		4		Fishway-poor
Crooked River		(6)Low		None
" "			(6) 10	None
McKay Creek			(5) 10	None
Ochoco Creek		110		None
" "			(5) 10	None
North Fork	25			None

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of Stream	Height in Feet Falls : Dams	Diversions in c.f.s.	Protective Devices
Squaw Creek	(10)Low		None
" "		(10) 10	None
John Day River	6		None
" "		10	None
" "	11 Low		None
" "		(7) 10	None
" "		(4) 10	None
South Fork	(1)Low		None
" "		(1) 10	None

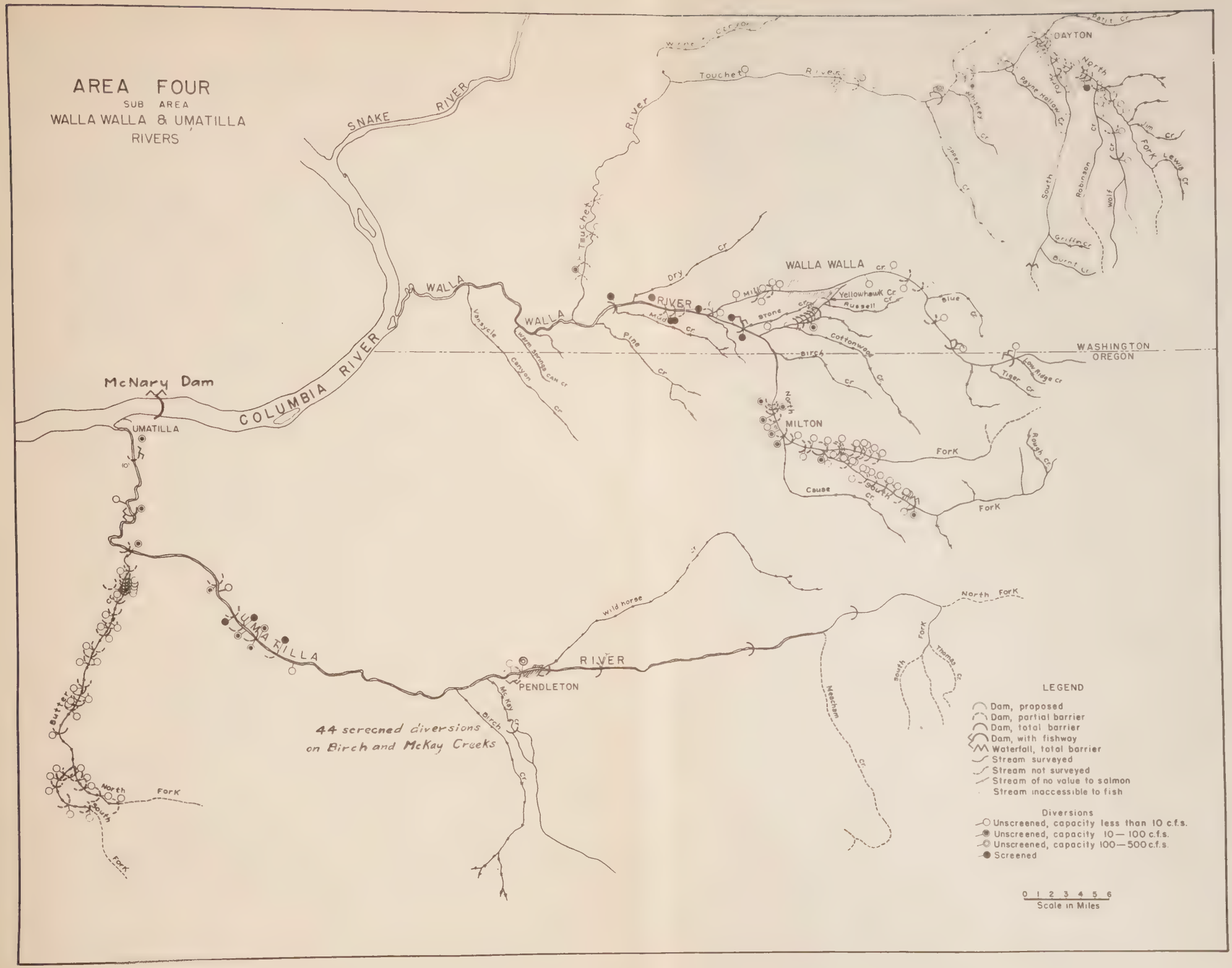


Figure 6. Umatilla and Walla Walla River System

PART 2

SUB-AREA UMATILLA AND WALLA WALLA RIVER SYSTEMS

List of Streams

	Page
4. Umatilla River	26
A. Butter Creek	27
(1) North Fork	28
(2) South Fork	28
B. Birch Creek	28
C. McKay Creek	28
D. Wildhorse Creek	28
E. Meacham Creek	28
F. North Fork	29
G. South Fork	29
(1) Thomas Creek	29
(2) Shimmiehorn Creek	30
5. Walla Walla River	31
A. Vansycle Canyon Creek	32
B. Warm Springs Canyon Creek	32
C. Gardena Creek	32
D. Touchet River	32
(1) Wynett Canyon Creek	33
(2) Copper Creek	33
(3) Whiskey Creek	33
(4) Sorghum Hollow Creek	33
(5) Payne Hollow Creek	33
(6) Patit Creek	33
(7) North Fork Touchet River	33
a. Wolf Creek	33
i. Robinson Creek	34
b. Rodgers Gulch	34
c. Weidman Gulch	34
d. Jim Creek	34
e. Lewis Creek	34
(8) South Fork Touchet River	34
a. Griffin Creek	35
b. Burnt Creek	35
E. Pine Creek	35
F. Dry Creek	35
G. Mud Creek	35
H. Mill Creek	35
(1) Blue Creek	36
(2) Henry Canyon Creek	36
(3) Tiger Creek	36
(4) Low Ridge Creek	36

Page

I. Little Walla Walla River 36
J. Stone Creek 36
K. Yellowhawk Creek 36
(1) Cottonwood Creek 37
(2) Reser Creek 37
(3) Russell Creek 37
L. Birch Creek 37
M. Couse Creek 37
N. North Fork Walla Walla River 37
O. South Fork Walla Walla River 38
(1) Elbow Creek 38
(2) Bear Creek 38
(3) Rough Creek 38
(4) Skiphorton Creek 38

4. Umatilla River.-- (May 24-26, 1944; Nielson. Sept. 18-20, 1945; Brewington, Davis, Hanavan, Parkhurst, Rucker, and Silliman.) Enters the Columbia River approximately 300 miles above the mouth near the town of Umatilla, Oregon. The point of entry is about 4 miles below McNary Dam on the Columbia River. The stream has a total length of about 119 miles from the mouth to the confluence of its north and south forks and averages 40-75 feet in width. Excellent suitable spawning areas exist in the upper half of the river and constitute in excess of 50 percent of the total bottom area. In the lower portion there are a few suitable spawning areas, but in general the bottom in this section consists of bedrock. At the time of our first survey (May, 1944) the flow at Pendleton was estimated at about 500 c.f.s. However, the entire flow is diverted by fifteen diversions in the 50-mile section below Pendleton. The channel was dry below the lowermost diversion dam located about 3 miles above the mouth of the stream. Summer water conditions may be critical as far upstream as the Dillon Canal dam 20 miles above the mouth. These conditions prevail throughout the entire irrigation season which ordinarily begins during the first week in June but may be as early as the middle of May, extending to late September or early October. Runs of spring chinook salmon and steelhead trout are thus blocked from entry into the river, except for a few early steelhead that enter before the entire stream flow is diverted. A few of these fish are taken each year by anglers above Pendleton.

There were seventeen water diversions and eleven principal dams on the main Umatilla River; fifteen diversions below Pendleton and two above. These are tabulated in upstream order at the conclusion of this part of the report.

The Western Land and Irrigation Company Canal, 29.7 miles above the mouth, was screened by the Oregon Game Commission in 1948.

The Echo Feed Canal, 30.9 miles above the mouth, was first screened in 1938 as part of the Public Works Program under the supervision of the U.S.Fish and Wildlife Service. This screen was converted to electric power in 1947 and put into regular operation in April, 1948.

The Furnish Canal, 35.7 miles above the mouth, also was screened by the Oregon Game Commission in 1948. The future program of the Commission calls for the screening of several other important diversions on the lower Umatilla.

There are eleven diversion dams on the river. The first permanent dams were built sometime during the period 1903-1907. These are the West Extension Canal and the Hermiston Light and Power Company dams located 4 miles and 10 miles, respectively, above the mouth of the stream. Both are of concrete construction and both have been provided with fishways since the initial construction. The efficiency of these fishways is amply demonstrated by the reports of local people that the largest run of chinook salmon within the memory of white men occurred in 1914. In that year, Indians and White people caught "thousands upon thousands of salmon from spring to fall". It was also reported that

noticeable declines in the numbers of salmon and steelhead followed that year. No one is certain just when the last salmon was seen, but all agree that they disappeared from the river sometime during the last 25 years.

In upstream order, the next six dams are constructed of concrete for the use of flashboards and are from 4 to 8 feet high. With the flashboards in place none of these dams is passable to the upstream migration of fish. This is due not so much to the height of the dams, but because the overflow spills across the entire crests of the structures onto concrete aprons of varying widths, making it impossible for fish to jump. These dams also have plank walkways above the flashboards that add to the difficulty of passage.

The next dam is located in the city of Pendleton. It is a concrete structure 4 feet high with a single flashboard crest and with a broken down, 5-step fishway at the south end. It is passable at all times at the north end near the point of diversion. The remaining two dams above Pendleton are temporary earth and rock structures that are passable at all times.

The limiting factor on the Umatilla River as it concerns chinook salmon and steelhead trout is a total lack of water near the mouth at the time of year that these fish are migrating. The potential value of the stream to these fish remains, but under existing conditions of water use this value is nullified.

The present demands for water irrigation are in excess of the available water during the critical summer season. This demand, together with the prospect of putting additional lands under irrigation, plus the demand for flood control in the Pendleton area, has prompted the U.S. Bureau of Reclamation to investigate the possibilities of water storage on the river. Two sites for storage dams have been studied above and below the confluence of Meacham Creek. Insofar as anadromous fish are concerned, until such time as an adequate sustained flow can be maintained in the lower Umatilla there is no necessity for improving conditions for the passage of fish, or for conducting further investigations preparatory to restocking the stream.

4A. Butter Creek.-- (May 27, 1944; Nielson.) Enters the Umatilla River 13 miles above the mouth. This stream is about 16.5 miles long from the mouth to the confluence of its north and south forks. The entire flow is diverted for irrigation, there being twenty diversions and twenty-two dams. All of the diversions are small, carrying from 1 to 5 c.f.s. The dams are all flashboard type structures with concrete bases and abutments. Butter Creek in its present condition is of no value to salmon or steelhead trout.

4A-(1). North Fork.-- (May 27, 1944; Nielson.) Joins the south fork to form Butter Creek 16.5 miles above the mouth of the latter. This is a small stream having a total length of about 15 miles. There are five dams and diversions, similar in all respects to the dams and diversions on main Butter Creek. This stream has no value to salmon or steelhead trout.

4A-(2). South Fork.-- (Inspected May 27, 1944; Nielson.) Joins the North Fork to form Butter Creek 16.5 miles above the mouth of the latter. This is a small stream having a total length of about 14 miles. There are five dams and diversions, similar in all respects to the dams and diversions on the North Fork and on Butter Creek. It has no value to salmon or steelhead trout.

4B. Birch Creek.-- (May 27, 1944; Nielson.) Enters the Umatilla River 7½ miles below Pendleton, Oregon, and has a total length of about 18 miles. Water for irrigation is extensively diverted and no attempt was made to enumerate each diversion. In the year 1948 the Oregon Game Commission installed forty-four fish screens on Birch Creek and McKay Creek. In addition about 12 miles above the mouth a feed canal diverts water to McKay Creek for storage in McKay Reservoir. Birch Creek at one time was an excellent steelhead stream, according to local reports. Suitable spawning areas were observed throughout. Because of present extensive water use, this stream must be considered as having no value to salmon.

4C. McKay Creek.-- (May 27, 1944; Nielson.) Enters the Umatilla River about 5 miles below Pendleton, Oregon. This stream, like Birch Creek, was at one time an excellent steelhead trout stream, suitable spawning areas being observed throughout. The McKay Reservoir dam, a rock and earth-fill structure over 100 feet high, is located about 5 miles above the mouth of the stream and forms a barrier to fish at that point. Suitable spawning areas were observed throughout the entire 5-mile section below the dam and constituted about 75 percent of the total bottom area. The stream flow is completely regulated below the dam. Very little, if any, water is released during the period of storage (November through April). There are numerous irrigation diversions screened by the Oregon Game Commission in 1948. McKay Creek is of no present value to salmon.

4D. Wildhorse Creek.-- (May 27, 1944; Nielson.) Enters the Umatilla River 1.5 miles above Pendleton, Oregon. This stream has a total length of about 25 miles, but is very small except at flood stage. The flow at the time of inspection was about 2 c.f.s., and it was reported to become almost completely dry in summer. Wildhorse Creek is of no present or potential value to migratory fish.

4E. Meacham Creek.-- (May 25, 1944; Nielson.) Enters the Umatilla River about 25 miles above the city of Pendleton, Oregon, and has a total length of about 20 miles. The average width of the stream near the mouth is about 50 feet, and at the time of inspection it was dis-

charging more water than the main Umatilla River at their confluence. The water temperature was 52°F. The stream was very turbid at the time of inspection, and it was difficult to estimate the suitable spawning areas. However, it flows through the same type of land as the main Umatilla River and should be comparable to the excellent spawning areas in that stream. It is the largest and most important tributary of the Umatilla. The Reclamation Service has investigated sites for a storage dam on the Umatilla above and below the confluence with this stream. There are no dams, diversions, or sources of pollution on Meacham Creek. Its present values for anadromous fish are nullified by the critical water use problem in the lower main Umatilla River.

4F. North Fork.-- (May 25, 1944; Nielsen.) Joins the south fork to form the main Umatilla River about 119 miles above the mouth. It is about 8 miles long, has an average width of about 30 feet near the mouth, and at the time of inspection was contributing about 50 percent of the flow of the main river at the point of entry (75 c.f.s). The water temperature was 47°F. This stream has a rather steep gradient, and suitable spawning areas are limited. There are no dams, diversions, or sources of pollution. The north fork is of some possible value to steelhead trout.

4G. South Fork.-- (May 25, 1944; Neilson.) Joins the north fork to form the main Umatilla River about 119 miles above the mouth. It is about 11 miles long, averages about 30 feet in width in the lower 4-mile section, and at the time of inspection was contributing about 50 percent of the flow in the main river. Unlike the north fork, this stream has a moderate gradient, suitable spawning areas are more extensive, and conditions generally are better for anadromous fish. The water temperature was 47°F. The gradient increases about 5 miles above the mouth and the stream divides into several small tributaries. There are no dams, diversions, or sources of pollution. The present value of the south fork to anadromous fish is greatly impaired by the critical water use problem in the lower main Umatilla River.

4G.-(1). Thomas Creek.— (May 25, 1944; Nielson.) Enters the south fork 3½ miles above the mouth, and has a total length of about 6 miles. At the time of inspection this stream was discharging about 30 c.f.s. The water temperature was 47°F. The gradient is steep, and suitable spawning areas are scattered and of small size. Much of the stream bed is composed of boulders and large rubble. There are no dams, diversions, or sources of pollution. Because of its size and limited spawning and rearing areas, this stream is only of minor potential value to anadromous fish.

4G.-(2). Shimmiehorn Creek.-- (May 25, 1944; Nielson.) Enters the south fork about 4½ miles above the mouth. It has a total length of about 7 miles, and an average width near the mouth of about 10 feet. The gradient is steep, and at the time of inspection the discharge was estimated at about 15 c.fs. There are no dams, diversions, or sources of pollution. Suitable spawning areas are limited, and the stream has only minor potential value to salmon and steelhead trout.

5. Walla Walla River.-- (February 12-13, 1935; and May 25, 1936; Suomela and Burrows.) Enters the Columbia River about 3 miles above the Oregon-Washington boundary line and about 23 miles above McNary Dam on the main Columbia River. The main stream is about 56 miles long from its mouth to the confluence of its north and south forks, all of which was surveyed. The average width varied from 100-150 feet near the mouth to 30-60 feet in the upper sections. The discharge into the Columbia River at the time of survey was about 100 c.f.s. From the mouth of the river to Mission Bridge (31 miles) the gradient is flat and the stream is very sluggish. There are no suitable spawning areas in this section, and the flow during the summer irrigating season is extremely low because of extensive diversions. However, the entire section above Mission Bridge (25 miles) contains excellent suitable spawning areas estimated to total 320,000 square yards, or in excess of 80 percent of the stream bed. There is, however, a peculiar condition present in the main river channel in this section that reduces the value of the spawning and rearing areas; for a distance of 2-1/2 miles below the Freewater bridge the river is absolutely dry during the summer for a period of from 2 to 4 months, effectively blocking the upstream and downstream passage of fish. This is partly due to irrigation diversions and partly to an absence of heavy sub-soil in the area. It is reported that at no time since the late 1880's has there been a flow of water through this section during the summer. The extensive diversion of water at the present time, of course, tends to cause this section to go dry much earlier than in former years. It is said that this stream section, known as the "Tumalum Branch", may go dry as early as May 15 in some years and in others as late as July 15. Because of the tremendous seepage that occurs in this section it takes almost a month for a normal flow of water to traverse it at the conclusion of the irrigation season.

There are fourteen dams and sixteen diversions on the main river. Six of the dams and seven diversions are located below the "Tumalum Branch" and the others above. All of the dams are passable to salmon and steelhead trout during high water stages, and only three are barriers during low water. These are the Burlingame Dam and the two dams at the Freewater bridge. They are not barriers because of size, but because they cause the entire flow to be diverted during the irrigation season. These three dams plus the Milton power dam, which is only 1 foot high, are the only permanent structures. All of the others are usually carried away by the spring freshets and must be rebuilt each year.

All of the diversions below the "Tumalum Branch" are screened, but none of those above is provided with protective devices of any kind. Since few, if any, adult salmon or steelhead are able to enter the upper stream sections under present conditions there is no necessity for screening these diversions from the standpoint of protection of anadromous fish.

At the time of survey steelhead trout were being caught in the main river above and below Mission bridge. However, the present runs do not compare in size with those that entered the river in former years. None of these fish were reported from the upper river sections.

The last chinook salmon run of any importance was reported in 1925. These fish ascended the river in May and early June, but it would be practically impossible for them to do so today under the present system of water use. Local people report that Nine Mile Dam, built in 1905 near Reese, Washington, was an effective though not a complete barrier to the upstream migration and that it was largely responsible for the decline in the runs of chinook salmon. This structure is no longer a barrier, since the river has cut a channel around it.

From all accounts the Walla Walla River at one time was a good producer of chinook salmon and steelhead trout, but it has little present or potential fisheries value.

5A. Vansycle Canyon Creek, 5B. Warm Spring Canyon Creek, and 5C. Gardena Creek.-- (May 25, 1936; Suomela and Burrows.) These small, intermittent streams enter the Walla Walla River from the south, below the confluence with the Touchet River. They are of no value to anadromous fish.

5D. Touchet River.-- (June 6-8 and 10-14, 1935; Burrows and Whiteleather.) Enters the Walla Walla River about 20 miles above the mouth. The river is about 61.5 miles long from its mouth to the confluence of its north and south forks, all of which was surveyed. Average widths varied from 75 feet near the mouth to 35 feet in the upper sections. At the time of survey the discharge was estimated at 75 c.f.s. Excellent spawning riffles and resting pools are well distributed throughout the course. It was estimated that there was over one million square yards comprising 60 percent of the stream bed suitable for spawning. There are twenty unscreened diversions. Fifteen of these have dams, only six of which are permanent structures. None is over 3.5 feet high, with the exception of the Preston-Shaeffer mill dam located 1½ miles above the city of Waitsburg, Washington. This dam is 6 feet high and is provided with an adequate fishway. The diversion at times may take the entire flow, leaving the channel dry for a distance of about 1 mile from the dam to the point of return below the mill. A similar problem occurs at the lowermost diversion on the river. This diversion, operated by the Touchet Irrigation Company, is located 5 miles above the mouth. It has a prior right for 30 c.f.s. and thus there is at least this amount of water in the stream above this point. However, during periods of low water this diversion withdraws the entire stream flow, leaving the 5-mile channel below the dam virtually dry with the exception of the deep, undrained pools. It is reported that these two situations would not be critical to upstream migrating chinook salmon and steelhead trout, since the dry periods occur later than the time of entry of these fish. The possible effects on the seaward migrants are not known.

Below the city of Waitsburg the river has an abundant population of suckers, chubs, and squawfish that would compete seriously with any form of food or game fish.

The chinook salmon run in the Touchet had been reduced to only a few fish at the time of the survey in 1935. A fair number of steelhead trout continue to enter the stream. Before the Nine Mile dam was constructed on the main Walla Walla River the Touchet was said to have had excellent runs of chinook salmon and steelhead.

The Touchet River has the best potential fishery value of any stream in the Walla Walla River system. It has no serious barriers to fish migration, and its diversions are mostly small. Suitable spawning, rearing, and resting areas are numerous and extensive.

5D-(1). Wynett Canyon Creek, 5D-(2). Copper Creek, 5D-(3). Whiskey Creek, 5D-(4). Sorghum Hollow Creek, 5D-(5). Payne Hollow Creek, and 5D-(6). Patit Creek.--(June, 1935; Burrows and Whiteleather.) These are all small, intermittent streams entering the Touchet River between the mouth and the confluence of the north and south forks. They are of no value to salmon.

5D-(7). North Fork Touchet River.-- (June 15-19, 1935; Suomela and Shuman.) Joins the south fork to form the main Touchet River 61.5 miles above the mouth of the latter. The stream has a total length of about 21 miles, of which the lower 19 miles were surveyed. Above this point it divides into several small branches of no possible value to salmon. The average width at the mouth was about 40 feet and near the upper terminus of the survey about 25 feet. The discharge at the time of survey was about 40 c.f.s. The stream is practically one continuous riffle broken only by a few large boulders and logs. Suitable spawning areas are excellent and extensive, forming over 68 percent of the stream bed, or about 150,000 square yards. Before the Nine Mile dam was built on the main Walla Walla River this stream supported large runs of chinook salmon and steelhead trout. No chinooks were observed during the survey, but a number of steelhead were seen on the riffles, and a few were caught by anglers. Unlike the main Touchet, this stream apparently has no population of suckers, chubs, or squawfish, as none of these fish were seen or reported. Dolly Varden, rainbow trout, and whitefish, are present in fair numbers.

There are eight low dams and thirteen small diversions withdrawing a total of only 18 c.f.s. None of the dams is a total barrier to fish. The city of Dayton water supply dam, 2 feet in height, is the only permanent dam. The diversion is screened.

5D-(7)a. Wolf Creek.-- (June 9-10 & 17, 1935; Suomela and Shuman.) Enters the North Fork 4 miles above the mouth. The stream is about 20 miles long, of which the lower 16½ miles were surveyed. It has an average width of about 25 feet, and at the time of survey the discharge was estimated at 30 c.f.s. Suitable spawning area was almost entirely lacking in the section above the terminus of the survey, but in the surveyed section these areas were extensive and

numerous, constituting about 75 percent of the stream bed or 130,000 square yards. In the lower 7-mile section suitable spawning area was estimated at about 90 percent of the stream bed. Only a few chinook salmon and steelhead trout enter this stream at the present time. Good runs were reported before construction of the Nine Mile dam on the main Walla Walla River.

There are five small, unscreened irrigation diversions carrying from 1 to 2 c.f.s. each. There are several low, temporary diversion dams, none of which is a total barrier to fish.

5D-(7)a-i. Robinson Creek.-- (June 11-15, 1935; Suomela and Shuman.) Enters Wolf Creek 2 miles above the mouth. This creek has a total length of about 12 miles, of which the lower 8 miles were surveyed. It has an average width of about 10 feet and at the time of survey the flow was estimated at about 9 c.f.s. It was estimated that there were 37,000 square yards of suitable spawning area, or about 82 percent of the stream bed in the section surveyed. In the lower 2-mile section suitable spawning area was estimated to be about 95 percent of the stream bed. These areas are little used by chinook and steelhead trout at the present time. Good runs of these fish were reported to have entered prior to the year 1900. There are no natural obstructions, dams, diversions, or sources of pollution. The potential fishery value of the stream is limited because of its small size.

5D-(7)b. Rodgers Gulch, 5D-(7)c. Weidman Gulch, 5D-(7)d. Jim Creek, and 5D-(7)e. Lewis Creek.--(April 28, 1937; Burrows & Whiteleather.) These are all small streams entering the north fork of the Touchet River above the confluence of Wolf Creek. At the time of inspection they were flowing from 4 to 5 c.f.s., and it is highly probable that they become nearly dry in summer. They all have steep gradients, lack suitable spawning areas, and must be considered as having no value to salmon.

5D-(8). South Fork of the Touchet River.-- (June 12-13, 1935; Suomela and Shuman.) Joins the north fork to form the main Touchet River 61.5 miles above the mouth of the latter. The south fork has a length of about 24 miles of which the lower 21 miles were surveyed. At this point an impassable falls blocks the upstream passage of migratory fish. The average width of the stream near the mouth was about 25 feet, and in the upper section about 6 feet. It was estimated that there were 200,000 square yards of suitable spawning area in the stream, or about 84 percent of the stream bed. The entire bottom area in the lower 2-mile section is suitable for spawning. Deep resting pools are numerous in the lower stream section. In the upper section the gradient becomes steeper and suitable spawning areas are limited. It is reported that at times the flow may become very low, and that under extreme conditions the stream may become completely dry in the lower mile. The deep pools, however, retain water and provide some protection for fish, since this drying up is of short duration. No salmon have been reported in recent years, but the south fork supports the largest run of steelhead trout of any stream in the Touchet river

system at the present time, according to local reports. Prior to the construction of the Nine Mile Dam on the main Walla Walla River the stream was reported to have also supported a good run of spring chinook salmon.

There are six small unscreened irrigation diversions carrying a total of only 2.5 c.f.s. There are only two small, temporary, low rock diversion dams that in no way interfere with the passage of fish. There are no sources of pollution.

5D-(8)a. Griffin Creek.-- (April 28, 1937; Burrows and Whiteleather.) Enters the south fork 13 miles above the mouth. This is a small tributary discharging about 4 c.f.s. It has a steep gradient, lacks suitable spawning area, and is of no value to salmon.

5D-(8)b. Burnt Creek.-- (June 13, 1935; Suomela and Shuman.) Enters the south fork about 14 miles above the mouth. The stream has a total length of about 10 miles, of which the lower 3.2 miles were surveyed. Above this point it is a series of steep cascades, and of no value to salmon. The average width of the stream was about 10 feet and the discharge at the time of survey was about 10 c.f.s. Suitable spawning area was confined to the surveyed section and amounted to about 13,000 square yards, or about 60 percent of the surveyed portion of the stream bed. There are no dams, diversions, or sources of pollution. It was reported that steelhead trout formerly entered this stream, but none do so at the present time. Burnt Creek is of limited potential value to anadromous fish.

5E. Pine Creek, 5F. Dry Creek, and 5G. Mud Creek.-- (April 22, 1937; Whiteleather.) These are all small streams flowing into the main Walla Walla River in a six-mile section above the confluence of the Touchet River. They are intermittent in character, lack suitable spawning areas, and are of no value to salmon or steelhead trout.

5H. Mill Creek.-- (February 15-18, 1935; Suomela and Burrows.) Enters the Walla Walla River about 6 miles below the city of Walla Walla. The stream is about 33 miles long, of which the lower 31 miles below the Walla Walla water supply dam was surveyed. The average width of the stream near the mouth was about 30 feet, and in the upper sections about 70 feet. At the time of survey the average depth of water was about 8 inches and the discharge about 20 c.f.s. Suitable spawning area was estimated at 330,000 square yards, or about 70 percent of the stream bed, with the best areas being noted in the 6-mile section below the city of Walla Walla. Water is taken from the stream by thirteen unscreened diversions. Dams are used in connection with only eight of the diversions, and only 4 of these are of a permanent nature. All of the dams are passable to migratory fishes with the exception of the uppermost, which formed the terminus of the survey. This dam is 12 feet high and has an ineffective fishway, thus blocking the upstream passage of fish. At a point about 1½ miles above Three Mile Bridge there is a diversion which carries two-thirds of the water of Mill Creek into Yellowhawk Creek. The entire

Mill Creek stream bed from this point to the city of Walla Walla is dry in summer. Springs and seepage which maintain a slight flow in the stream course through the city is also diverted below the town, often leaving the channel completely dry from there to the mouth.

The domestic sewage of the city of Walla Walla is given primary treatment and discharged into the stream.

At the time of survey there were a few steelhead trout in the lower stream section, but none in the upper portion. It was reported that Mill creek at one time supported extensive runs of these fish. No chinook salmon have been reported from the stream for many years.

Mill creek is of little or no potential value to anadromous fish.

5H-(1). Blue Creek, 5H-(2). Henry Canyon Creek, 5H-(3). Tiger Creek, and 5H-(4). Low Ridge Creek.-- (April 22, 1937; Burrows & Whiteleather.) These are small intermittent tributaries of Mill creek. None of the Mill creek tributaries is of value to anadromous fish.

5I. Little Walla Walla River.-- and
5J. Stone Creek.-- (April 22, 1937; Burrows & Whiteleather.) These are tributaries of the Walla Walla River entering in the vicinity of Mission bridge. The little Walla Walla River is only about 4 miles long and is used largely as a waste ditch for irrigation water. It is a mud bottom stream having no suitable spawning areas, and is of no value to salmon.

All of the water of Stone creek is diverted for irrigation, and it has no value to salmon.

5K. Yellowhawk Creek.-- (June 21, 1935; Burrows.) Enters the Walla Walla River about 3 miles above Mission bridge. The stream is 8 miles long and was completely surveyed. The greater part of the flow is obtained by diversion from Mill creek, and at the time of survey was estimated at 25 c.f.s. The stream has a relatively flat gradient and a mud bottom in some places. However, suitable spawning area was estimated at about 65,000 square yards, or approximately 70 percent of the stream bed. Pools are not numerous but the deep channels provide adequate resting places for fish.

There are twenty-nine unscreened diversions, all relatively small since the total quantity of water diverted by them is only 25 c.f.s. There are only seven dams in connection with these diversions, three of which are small, low structures passable without difficulty. Considering the more important permanent dams in upstream order, the first is the Whitney dam, 4½ feet high. It has no fishway but is easily passable at the spillway. The second is the Walla Walla mill

dam, 6 feet high, and provided with an adequate fishway. The third is the Ankeny dam,6 feet high,with a broken down fishway. It is reported that steelhead easily pass this dam during high water, but it is a low water barrier. The fourth is the Brehm dam, 4½ feet high, with two fishways, only one of which is of sufficient size to be usable by large fish. Steelhead can jump the face of this dam during high water stages.

No salmon have been seen in Yellowhawk creek for years, and at the present time, only a few steelhead trout enter and pass into Mill creek. In its present state Yellowhawk creek is practically worthless to these fish.

5K-(1). Cottonwood Creek, 5K-(2). Reser Creek, and 5K-(3). Russell Creek.--(June 21, 1935; Burrows.) These are small intermittent tributaries of Yellowhawk creek that are of no value to salmon. Their entire flows are diverted for irrigation.

5L. Birch Creek.-- (April 22, 1937; Burrows and Whiteleather.) Enters the Walla Walla river at the Oregon-Washington state line. At the time of survey the discharge was estimated at about 5 c.f.s., and it is reported that the stream becomes almost dry during the summer. It is a slow flowing stream with a stream bed composed almost entirely of mud. It is of no value to salmon or steelhead trout.

5M. Couse Creek.-- (April 22, 1937; Burrows and Whiteleather.) Enters the Walla Walla River near Milton, Oregon. This stream is too small to be of importance to fish although it is reported that a few steelhead trout continue to enter.

5N. North Fork Walla Walla River.-- (June 22, 1935, and June 22-25, 1936; Burrows & Whiteleather.) Joins the south fork to form the main Walla Walla River 56 miles above the mouth. The stream is about 17 miles long and was surveyed upstream for a distance of 11.7 miles. The survey was terminated at this point because the stream above was too small and lacked suitable salmon spawning area. The average width near the mouth was about 30 feet and near the terminus of survey about 7 feet. The estimated discharge was 13.5 c.f.s. This stream has excellent, suitable spawning areas estimated to total 100,000 square yards, or approximately 66 percent of the stream bed. Resting pools are numerous in the lower stream section. There are nine small unscreened irrigation diversions carrying a maximum total of 7 c.f.s. Small, temporary dams are placed across the stream in connection with each of the diversions, usually about the middle of May. All of them are easily passable to fish during high water stages, but four may be barriers during low water. The dams and diversions are located in the first 4-mile section above the mouth. There are no natural barriers, and no sources of pollution.

An occasional steelhead trout is taken from this stream, but no salmon have been seen or reported for many years. Conditions are excellent for both salmon and steelhead, but the anadromous fishery value is

nullified by stream conditions on the main Walla Walla River.

5-O. South Fork Walla Walla River.— (February 14, 1935, and June 20, 1936; Burrows and Whiteleather.) Joins the north fork to form the main Walla Walla River 56 miles above the mouth. It has a total length of about 24 miles, of which the lower 21.8 miles was surveyed. The average width near the mouth was from 35 to 40 feet, and in the upper section about 15 feet. It was estimated that the stream was discharging about 60 c.f.s. at the time of survey, but it was reported that it may become completely dry near the mouth during some summer seasons.

Suitable spawning area was estimated to comprise 245,000 square yards, or about 67 percent of the stream bed. Resting pools are adequate. The stream could easily support large runs of chinook salmon and steelhead trout. A fairly good spring run of steelhead trout continues to enter, but no salmon have been seen since 1925. Existing conditions on the main Walla Walla River are largely responsible for this condition, and constitute the limiting factor in realizing the potential value of this stream to chinook salmon and steelhead trout.

Water is taken from the stream by sixteen irrigation and two power diversions, none of which is screened. There are eight temporary dams, passable at all times, in connection with the irrigation diversions, and two permanent dams, each 4 feet high, in connection with the power diversions. The lowermost power dam is operated by the city of Milton Power Company, and is located about 1/2 mile above the mouth of the stream. It has no fishway, but is a barrier to fish only during low water stages. The unscreened diversion carries about 70 c.f.s. The second power dam is owned by the Pacific Power and Light Company, and is the uppermost structure on the stream. It has an adequate fishway and is passable at all times. The unscreened diversion carries 80-100 c.f.s. All of the irrigation diversions are small, the total irrigation diversion by the 16 ditches being slightly less than 15 c.f.s. All of the dams and diversions are located in the lower 8-mile section of stream.

Present conditions on the main Walla Walla River greatly reduce the value of this stream for anadromous fish.

5-O-(1). Elbow Creek, 5-O-(2). Bear Creek, and 5-O-(3). Rough Creek.— (June 23, 1936; Burrows and Whiteleather.) These are small, headwater tributaries of the south fork of the Walla Walla. They are intermittent, have steep gradient, and are of no value to salmon.

5-O-(4). Skiphorton Creek.— (June 23, 1936; Burrows and Whiteleather.) This is a small headwater tributary of the south fork with a total length of about 2 miles, of which the lower 1/2 mile was surveyed. The width varied from 7 to 15 feet, and the discharge was estimated at 10 c.f.s. It is fed, maintaining a fairly uniform flow and low summer water temperatures. Suitable spawning area was estimated at only 1,100 square yards, and constituted 25 percent of the stream bed. The stream bed contains numerous large boulders. The gradient is steep above the terminus of the survey where the stream is scarcely more than a series of cascades. A few steelhead trout are said to enter, but the stream is of little possible value to salmon.

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of stream	Height of dam 1/ or fall (feet)	Diversion in c.f.s.	Existing protective devices
Umatilla River			
Brownell Ditch	2	28	
West Extension Canal	24	225	Fishway
Beitle Ditch	0.5	1	
Hermiston Power and Light Canal	20	30	Fishway
Maxwell Canal	4	96	
Dillon Canal	2	20	
Unnamed diversion at Echo	1	1	
Western Land and Irrig. Co.Canal	4	292	Screened
Echo Feed Canal	5	284	Screened
Ramos Canal	None	12	
Wilson Ditch	None	17	
Taylor Ditch	None	28	
Furnish Canal	2.5	155	Screened
Slusher Ditch	2	10	
Unnamed diversion near Rieth	None	1	
State hospital diversion	2	8	
Walters mill power canal	4	122	Poor fishway; diversion not in use
Rugg Bros. ditch	2		Not in use
Butter Creek	(22) 2-4		None - stream of no value
" "		(20) 10 -	None - stream of no value
North Fork	(5) 2-4		None - stream of no value
" "		(5) 10 -	None - stream of no value
South Fork	(5) 2-4		None - stream of no value
" "		(5) 10 -	None - stream of no value

1/ Numbers shown in parentheses are total number of dams, falls, or diversions.

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of stream	Height of dam or fall (feet)	Diversion in c.f.s.	Existing protective devices
Umatilla River (Continued)			
Birch Creek	numerous		None - stream of no value
" "		numerous 10 -	Screened " " " "
McKay Creek	(1) 100+		None - stream of no value
" "	numerous		None - stream of no value
" "		numerous 10 -	Screened " " " "
Walla Walla River	(12) Low		None
" "	1½		Fishway
" "	1		Fishway
" "		(7) 10+	Screened
" "		(5) 10 -	None
" "		(5) 10+	None
Touchet River	(14) Low		None
" "	6		Fishway
" "			
" "		(4) 10+	None
		(16) 10 -	None
North Fork Touchet River	(13)Low		None
" " " "		(13) 10 -	None
Wolf Creek	(3) Low		None
" "		(5) 10 -	None
South Fork Touchet River	(1) High		None
" " " "	(2) Low		None
" " " "		(6) 10 -	None
Mill Creek	6		Fishway
" "	12		Fishway
" "	(6) Low		None
" "		(11) 10 -	None
" "		(2) 10+	None

TABLE OF OBSTRUCTIONS AND DIVERSIONS

Name of stream	Height of dam or fall (feet)	Diversion in c.f.s.	Existing protective devices
Walla Walla River (Continued)			
Yellowhawk Creek	4½		None
" "	6		Fishway-Good
" "	6		Fishway-Poor
" "	(4) Low		None
" "		(29) 10-	None
North Fork Walla Walla River	(9) Low		None
" " " "		(9) 10-	None
South Fork Walla Walla River	4		None
" " " "	4		None
" " " "	(6) Low		None
" " " "		(2) 10+	None
" " " "		(16) 10-	None